

Moles Lab Activity 1: PCU (Popcorn Counting Units)

Materials

A container of each of the following:

- Popcorn kernels
- Kidney beans
- Pinto beans
- Peas
- Lima beans
- Navy beans
- A large unopened bag of popcorn
- Kernels
- Balance
- Safety goggles

Objective

To devise a new counting unit, use it in calculations, and compare it to the use of a mole.

Procedure

Part 1

1. Weigh out 5.0 grams of popcorn kernels on the balance, and count the number of kernels there are in 5.0 grams. This *number* will be called “**1 PCU**” (1 popcorn counting unit).
2. Complete the following equation in your data record:
1 PCU = _____ kernels = 5.0 g of kernels
3. Show how you would calculate the number of kernels in 3 PCUs:
4. Show how you would calculate the number of kernels in 20.0 grams of popcorn:
5. Show how you would calculate the mass, in grams, of 100 popcorn kernels:

6. Complete the table at right.

7. Use the balance to find the mass, in grams, of the unopened bag of popcorn kernels. Mass:

8. Use the mass of the popcorn bag and your PCU to determine how many kernels are in the bag. Show your work here, and record your answer on the class data table.

9. Based on the class data table, what is the average number of kernels in the popcorn bag?

Number of popcorn kernels	Number of PCUs	Mass of popcorn kernels (g)
	2	
	10	
	500	
		10.0
		650.0
		5.0×10^5
1		
498		
7,000		
5.0×10^8		

10. How close to the class average number is the number you found?

11. Explain what could account for the different numbers of kernels calculated by each student.

12. We can use a PCU just like a dozen is used. When we count out a dozen eggs, bagels, and marbles, we know that the mass of each dozen will not be the same. Would you expect 1 PCU of lima beans to weigh the same as 1 PCU of popcorn kernels? _____ Explain your answer.

13. How many popcorn kernels have you determined to be equal to 1 PCU? If you were counting out 1 PCU of marbles, how many marbles would you count out? _____ If you were counting out 1 PCU of each type of bean, how many of each would you count out?

14. Count out 1 PCU of pinto beans. This will be the number of pinto beans equal to the number of kernels in one PCU. Use a balance to determine the mass of 1 PCU of pinto beans and record in the table below.

Part 2

1. Complete the data table at right, keeping in mind that the number of particles in a PCU is always the same.

2. Is the number of kidney beans in 1 PCU more than, less than, or equal to the number of navy beans in 1 PCU?

3. How does the mass of 1 PCU of kidney beans compare to the mass of 1 PCU of navy beans? _____

How can you account for the differences in mass that you observed?

Type of particle	Number of particles in 1 PCU	Mass of 1 PCU
Pinto bean		
Kidney bean		
Lima bean		
Pea		
Navy bean		

4. Would 5.0 grams of kidney beans be more than, less than, or equal to the mass of 1 PCU of kidney beans? _____
 Would 10.5 grams of peas be more than, less than, or equal to the mass of 1 PCU of peas? _____
5. Why is a mole a better unit than a PCU for counting atoms?
6. How many particles are in a mole? _____

Extension

- Fill in the table at right.
- Explain how the mass of one mole of magnesium atoms compares to the mass of one mole of iron atoms.
- Just as our masses in this lab can be based on popcorn kernels, the atomic masses of each element on the periodic table can be (and are) based on one element. What element is it?

Element	Symbol	Mass of 1 mole	Number of particles	Number of moles	Mass of sample (g)
Carbon			6.02×10^{23}	1	12
Carbon			1.2×10^{24}	2	
Carbon				3	36
Carbon				0.5	
Carbon					3
Magnesium					24.3
Silicon					14
Neon			6.02×10^{22}		
Iron				3	